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(56) Documents Cited

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(58) Field of Search

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(54) Abstract Title

**Manufacturing externally profiled glass tubes**

(57) A process for manufacturing externally profiled tubes where molten glass flows along a space (7, fig 2) between an inner member 1 and an outer casing 2 which is held at a predetermined spacing from the inner member 1 by means of webs 3 and is in direct contact with the glass. The externally profiled tubes may be used for the manufacture of microdiodes.

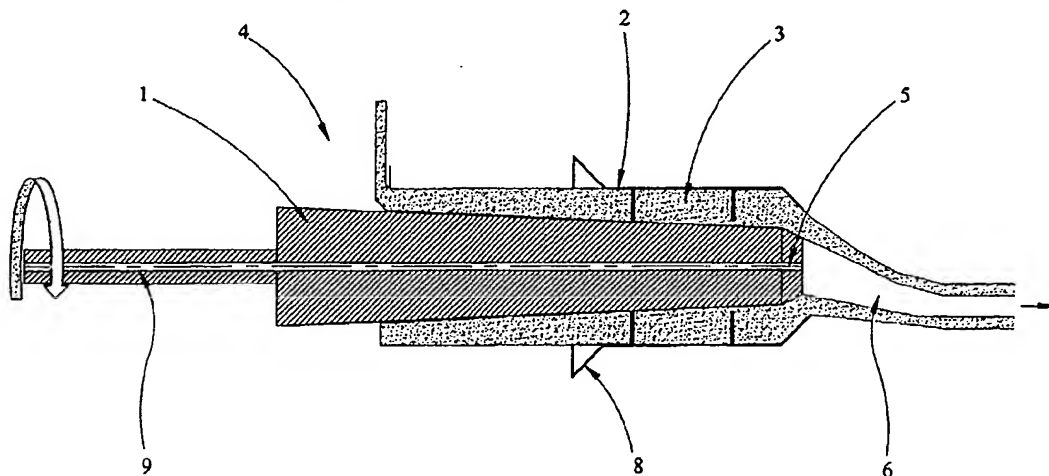


FIG 1

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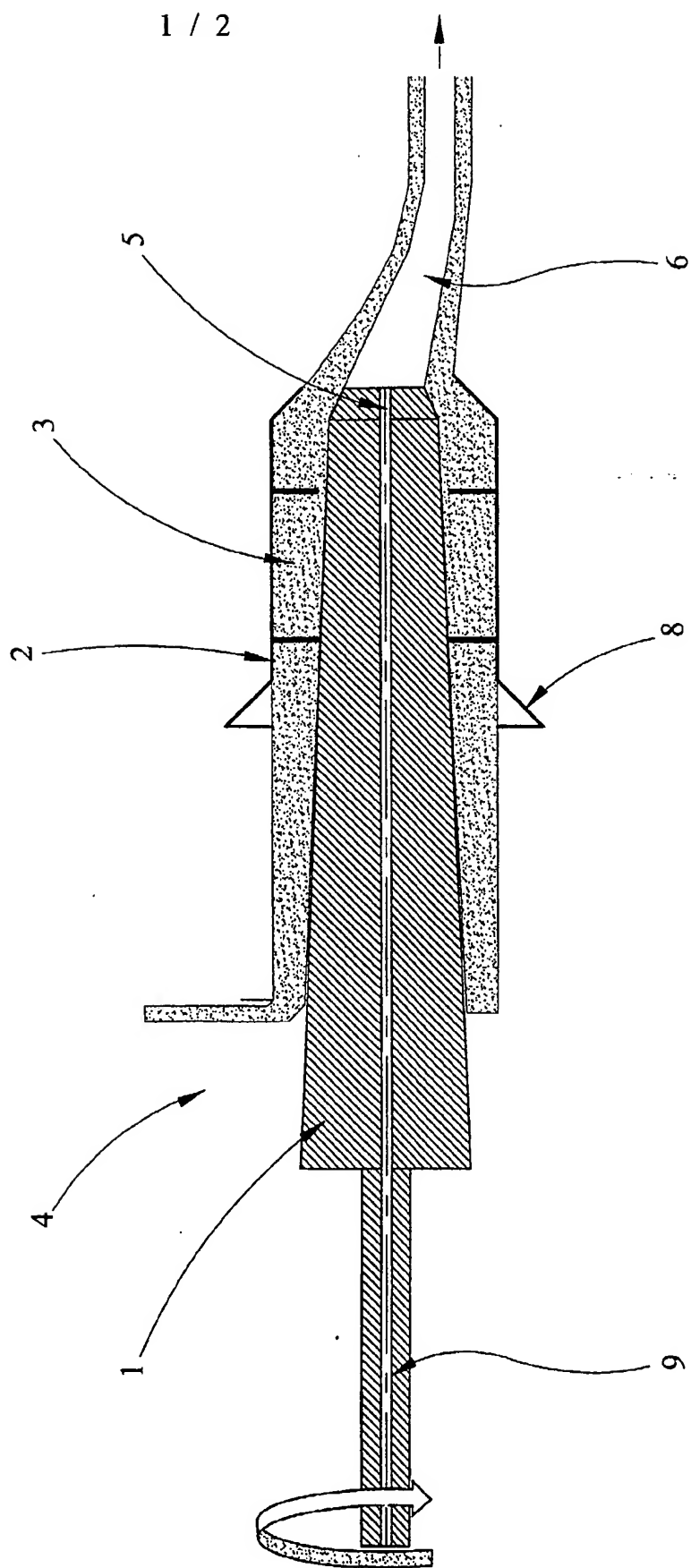


FIG 1

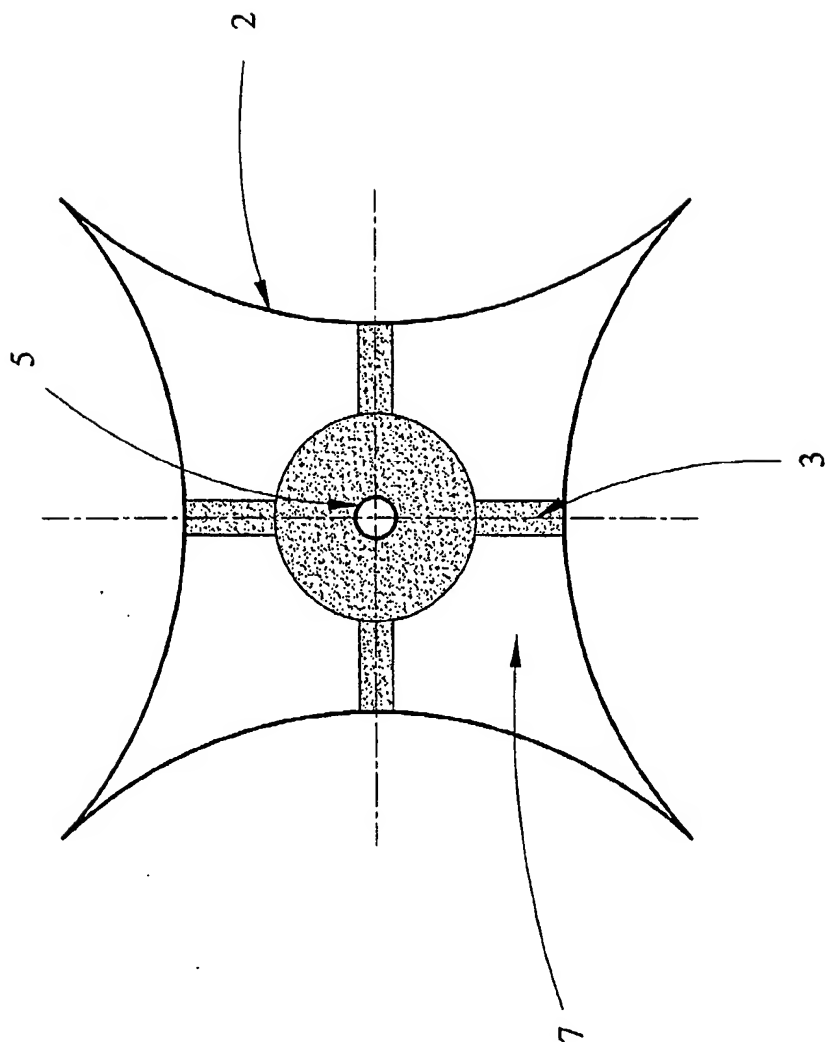


FIG 2

### **Process for Manufacturing Externally Profiled Tubes**

The present invention relates to a process for manufacturing externally profiled tubes.

In the manufacture of glass tubing by the Danner process, a so-called Danner pipe serves as a drawing tool. The Danner pipe is positioned at a slight incline and rotates slowly, and receives a continuous ribbon of molten glass. At the lower end of the Danner pipe (the pipe head), the glass is drawn off, forming a drawing bulb, with a hollow space being produced by feeding air through a hollow shaft of the pipe. After being deflected to the horizontal, the solidifying tube passes through a roller path to a drawing machine, downstream of which separation into tube sections is performed by chopping off.

The Danner process provides for free surfaces of 0.1 to 2 m<sup>2</sup>. In the case of glasses having a B<sub>2</sub>O<sub>3</sub> content of > 5% by weight and also having an alkali content, there is pronounced evaporation of alkali borates. The glass surface is enriched with SiO<sub>2</sub> and thus results in streaking and poor dimensional stability in the external diameter of the glass tube to be made.

An object of the present invention is to provide an environmentally friendly and economic Danner process for manufacturing externally profiled tubes.

According to the present invention, there is provided a process for manufacturing an externally profiled tube, comprising the steps of causing molten glass to flow between an inner member and an outer casing which is held spaced from the inner member by means of webs and which is in direct contact with the glass, and removing the resultant externally profiled tube.

The advantage of the Danner-type process in accordance with the invention resides in the fact that externally profiled tubes can be manufactured economically and precisely.

A preferred embodiment of the invention is a process in which the inner member has a base body which is sheathed in a precious metal, and the outer casing and the webs are made from a metal, metal alloy, a precious metal or a precious metal alloy.

The inner member may be tapered inwardly in the direction of its downstream end.

A preferred embodiment of the invention is a process in which the outer casing is constructed, downstream of the point at which glass flows onto the inner member, in the form of a funnel. The funnel aids in directing the glass into the space between the inner member and the outer casing.

A preferred embodiment of the invention is a process in which the funnel is at an angle of  $5^{\circ}$  to  $70^{\circ}$ , preferably  $20^{\circ}$  to  $40^{\circ}$ , to the surface of the inner member. Very good results are achieved with these angles.

A preferred embodiment of the invention is a process in which the outer casing begins 300 mm before a break-off edge of the inner member and ends in the plane of the break-off edge at which the glass becomes detached from the inner member. The spacings from the infeed point of the molten glass can be adjusted depending on the desired throughput. The throughput of molten glass may vary from 10 kg/h to 1000 kg/h. The inner member is preferably 1300 mm long.

A preferred embodiment of the invention is a process in which the webs are arranged in at least two planes with at least three webs and have an oval shape which is favourable to flow. The flow resistance  $c_w$  is  $< 0.3$ , preferably  $\leq 0.1$ .

According to the invention, the use of the Danner process having an outer casing is also provided for manufacturing externally profiled tubes. The

externally profiled tubes form, for example, the starting product for the manufacture of externally profiled microdiodes.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic axial section through equipment used in a process for producing externally profiled tubes in accordance with the present invention, and

Fig. 2 is a schematic cross-sectional view through the equipment of Fig. 1.

The equipment comprises a Danner pipe (1) which forms an inner member formed of a ceramic base body which is sheathed with a precious metal. An outer precious metal casing (2) is held at a predetermined spacing from the Danner pipe (1) by means of precious metal webs (3). The outer casing (2) is profiled and brings about the external profiling of the tubes as a result of direct contact with the glass. With the Danner process there is a point (4) at which glass flows onto the Danner pipe (1) and a profiled drawing bulb (6) where the glass becomes detached from the pipe (1) at a break-off edge (5). By feeding air through a bore (9) of the Danner pipe (1), a hollow space is created in the profiled drawing bulb (6). The Danner pipe (1) has a length of 1300 mm and a diameter of 220 mm. The outer casing (2) begins 300 mm before the break-off edge (5) and ends in the plane of the break-off edge (5). The glass runs into the annular gap (7) formed between the Danner pipe (1) and the outer casing (2). The outer casing (2) is constructed in the form of a funnel (8) at the infeed point of the molten glass. The funnel (8) has an angle of 30° in this embodiment.

As can be seen in Fig. 2, in this embodiment, there are four webs (3) each at an angle of 90°. Although not shown in the drawings, the webs (3) have an oval profile to reduce the flow resistance to glass passing along the gap

between the pipe (1) and the outer casing (2). The profile of the casing (2) can be seen in Fig. 2.

The pipe (1) and the casing (2) are rotated in use in the direction of the arrow in Fig. 1.

### **CLAIMS**

1. A process for manufacturing an externally profiled tube, comprising the steps of causing molten glass to flow between an inner member and an outer casing which is held spaced from the inner member by means of webs and which is in direct contact with the glass, and removing the resultant externally profiled tube.
2. A process according to Claim 1, in which the inner member has a base body and is sheathed in precious metal and the outer casing and the webs are made from metal, metal alloy, precious metal or precious metal alloy.
3. A process according to Claim 1 or 2, in which the outer casing is constructed, downstream of the point at which glass flows onto the inner member, in the form of a funnel.
4. A process according to at least one of Claims 1 to 3, in which the funnel is at an angle of  $5^{\circ}$  to  $70^{\circ}$  to the surface of the inner member.
5. A process as claimed in claim 4, wherein the angle is  $20$  to  $40^{\circ}$ .
6. A process according to any one of Claims 1 to 5, in which the outer casing begins 300 mm before a break-off edge of the inner member and ends in the plane of the break-off edge where the glass becomes detached from the inner member.
7. A process according to any one of Claims 1 to 6, in which the webs are arranged in at least two planes with at least three webs and have an oval shape which is favourable to flow.
8. A process as claimed in claim 1, substantially as hereinbefore described with reference to the accompanying drawings.



9. Externally profiled tubes when manufactured by a process as claimed in any preceding claim.
10. The use of externally profiled tubes according to claim 9 for the manufacture of microdiodes.

**Amendments to the claims have been filed as follows**

1. A process for manufacturing an externally profiled tube, comprising the steps of causing molten glass to flow between an inner member and an outer casing which is held spaced from the inner member by means of webs and which is in direct contact with the glass, and removing the resultant externally profiled tube, the inner member has a base body and is sheathed in precious metal and the outer casing and the webs are made from metal, metal alloy, precious metal or precious metal alloy.
2. A process according to Claim 1, in which the outer casing is constructed, downstream of the point at which glass flows onto the inner member, in the form of a funnel.
3. A process according to any one of Claims 1 or 2, in which the funnel is at an angle of  $5^{\circ}$  to  $70^{\circ}$  to the surface of the inner member.
4. A process as claimed in Claim 3, wherein the angle is  $20^{\circ}$  to  $40^{\circ}$ .
5. A process according to any one of Claims 1 to 4, in which the outer casing begins 300 mm before a break-off edge of the inner member and ends in the plane of the break-off edge where the glass becomes detached from the inner member.
6. A process according to any one of Claims 1 to 5, in which the webs are arranged in at least two planes with at least three webs and have an oval shape which is favourable to flow.

7. A process substantially as hereinbefore described with reference to the accompanying drawings.
8. An externally profiled tube when manufactured by a process as claimed in any preceding claim.
9. The use of externally profiled tubes according to Claim 8 for the manufacture of microdiodes.



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Claims searched: 1-10

Examiner: Colin Clarke  
Date of search: 17 October 2002

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.T): CIM (MEB,MED,MEF)

Int CI (Ed.7): C03B 17/04

Other: ONLINE: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2208165 A SCHOTT see pp 13-15 & figs	1 & 2 at least
X	DE 4312744 A KUEMMERLING see abstract & figs	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.